ON THE

# STATION POINTER

AND THE MANNER OF

# FIXING A SHIP'S POSITION BY ITS AID.

PUBLISHED BY ORDER OF THE LORDS COMMISSIONERS OF THE ADMIRALTY.

LONDON:
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J. D. POTTER, AGENT FOR THE SALE OF ADMIRALTY CHARTS,
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SECOND EDITION.
1903.

*Price Sixpence.*

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## On the Station Pointer and the manner of fixing a Ship's Position by its aid.

The fixing of a ship's position by sextant angles instead of compass bearings, is often in many ways preferable. The position is more exact, as the angles can be measured with greater precision than the compass will permit.

It is especially valuable when the objects available are at a considerable distance, as measured in inches on the chart, from the observer. The mere drawing of long lines of bearing introduces error difficult to avoid.

The observer is not tied to any one spot, and can, therefore, place himself in the most advantageous position to see the objects clear of masts, boats, &c., which, from the compass of a modern man-of-war, ordinarily obscure so many points.

The oscillation of a compass, when rolling or from any other cause, frequently induces delay or incorrectness in the bearings.

In action, in pilotage water, the use of the sextant is invaluable, as few compasses stand the concussion of modern guns, and, moreover, the compass is necessarily so exposed that it is liable to be knocked away. It is more especially in view of its use on such occasions that it is desirable that officers should be familiar with the method of fixing by angles.

Tracing paper can be used for placing the angles upon the chart, but a necessary adjunct for *prompt* transference of the angles observed is the "station pointer."

The theory of the station pointer is founded upon the 21st Proposition of Euclid, Book III., which shows that the angles subtended by the chord of the segment of a circle, measured from any point in the circumference, are equal.

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Thus in the figure (1) :

If the angle between A and B is observed to be, say 60° ; the observer knows that he is somewhere on the circumference A E D B, on any part of which, as at E or D, the angle subtended by A B will be the same. *

The measurement, therefore, of an angle between two objects gives this much information; that the observer is on the circumference of a circle which passes through the two objects, the diameter of which circle varies according to the angle, with an equal length of A B. *See* Figs. (1) when A E B=60°, and (2), A G B = 30°.

This alone is often useful information to the mariner. Thus, if a rock exists at X (Fig. 2), and two well-defined objects exist at A and B, he has only in passing to take care that the angle measured between them is considerably smaller than that measured at X, which can be taken from the chart, to ensure his passing outside its position.

To find the precise position of the ship at any moment, however, more is wanted. This can be provided by a second angle between two other objects, which will also give a circle on the circumference of which the observer must be. It is evident that where these two circles cut one another is the observer's position, for though he may be at E, Fig. (3), so far as his angle A to B is concerned, at that position the angle he has observed between C and F will not agree, nor will it do so unless the observer is on the circle C D H F, and he can only be on both circles at once at D.

Now, if instead of taking the objects C F to measure the second angle, B, one of the objects before taken is again used, and the angle measured between it and C or F, the problem is simplified in every way. This is shown in Fig. (4) when the second angle has been taken between B and C. Here the observer must manifestly be also at D, from the same reasoning as in the foregoing paragraph.

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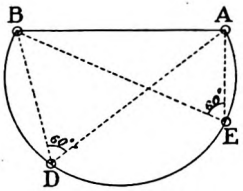
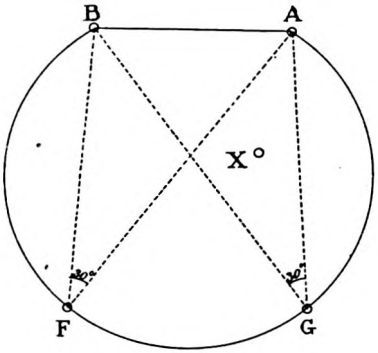
* To describe this circle lay off from each object an angle making with the other object an angle equal to the complement of the angle observed. The point where these two lines intersect is the centre of the circle. Should the observed angle be more than 90°, lay off the number of degrees over 90° on the opposite side of the line joining the objects.

(1)




(2)

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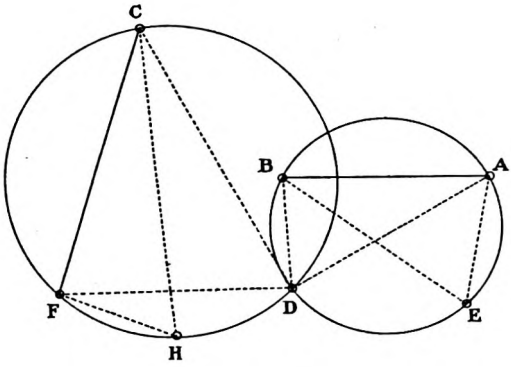
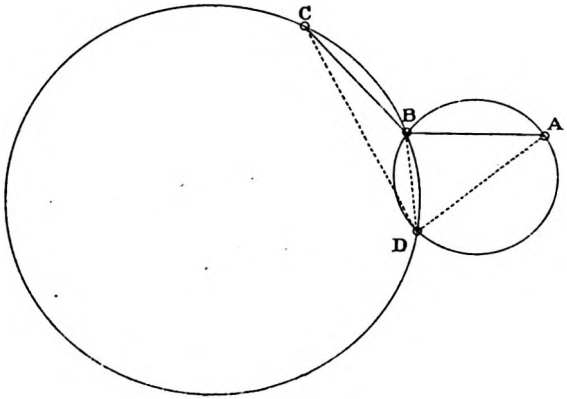
(3)




(4) *Good.*

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We also have a third circle involved, viz., that drawn through the two outer objects and the observer's position.

The position of this circle with reference to the other is sometimes of great importance, and will be referred to later.

The drawing of these circles is a matter which occupies some time, and requires great care when accuracy is desired; but tracing paper on which the angles are plotted, or more especially the station pointer, gives us the means of ascertaining the position D readily, quickly, and accurately, when three objects are used under certain conditions.

The Station Pointer is composed of three legs radial to a common centre, two of which are movable, with an arrangement for setting them at the required angles from the central fixed leg.

The right leg being set to the angle measured between A and B, and the left leg to that between B and C, place the instrument on the chart with the chamfered edge of the central leg directed to B, and move the instrument until the chamfered edges of the right leg falls on A, and that of the left on C.

The centre of the instrument must then be on the position where the two circles, if drawn, would intersect, as from no other position would all the legs, set at the proper angles, coincide with the objects.

A dot made by a sharp pencil or needle, at the centre, marks the position.

It may tend to make the principle of the instrument plainer to one unacquainted with it, if a series of positions be dotted or pricked with, first, the central and right legs (the latter set to the observed angle), brought into contact with the centre and right hand objects, without any regard to the left leg; secondly, doing the same with the left and central legs, coinciding with their objects; and thirdly, with the two outer legs in coincidence with their objects.

It will then be seen that these lines of dots will form arcs of the circles which would be drawn by Euclid's proposition, and that they intersect at the point where all three objects are in contact with the three legs.

## Precautions.

It will appear, on consideration, that several points have to be regarded in using this method of fixing the ship's position.

First.—As in the case of fixing by means of compass bearings, it is necessary, when accuracy is essential, to have a "check." If when using the compass only two bearings are observed, there is no assurance that a mistake has not been made in taking or laying off the bearings. But if three bearings are observed, and when laid down intersect or nearly intersect in one spot, they give you, besides the information you desire as to the position of the ship, also (A) an assurance that no mistake has been made in taking the bearings; (B) that the objects selected are those which you believe them to be; (C) that the objects are properly placed upon the chart. (D) It is seen by the lines drawn at what angles they intersect, and the value of the position is thus known.

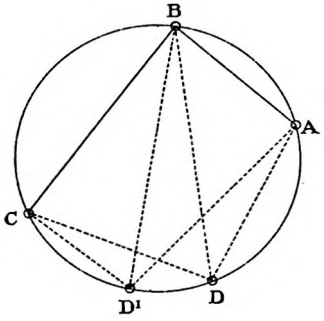
These assurances are absent (or in the case of (D) not evident) when the station pointer is used to plot a position *from two angles only*.

Any error, either in the original observation of the angle with the sextant; or in setting the legs of the station pointer; or mistakes in the objects used; or errors in the chart, when this is founded on a sketch survey, may pass undetected.

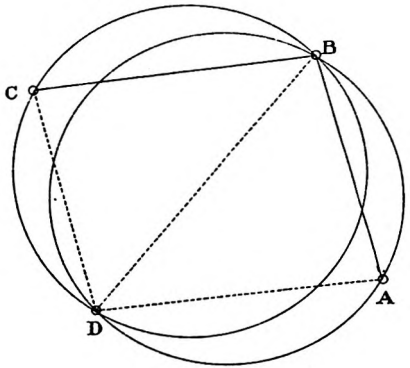
*It is, therefore, necessary*, particularly on getting the first fix on approaching the land, or on using a fresh chart, to *take a third angle to a fourth object*, and when the position has been plotted by two of the angles, to reset one of the legs to the third angle, and, placing the instrument on the chart again, with the centre on the supposed position, and the central leg on the object already used, and from which the third angle has been measured, see if the fourth object coincides with the edge of the leg reset. Should this agree, confidence may be felt that all is correct.

Another method of checking the position given by two angles is to take a bearing at the same time, and see if it agrees with that on the chart from the position plotted. The object selected should be that the bearing of which is most rapidly altering from the change of position of the ship, and will generally be therefore that nearest abeam. Should either of these checks disagree, something is wrong.

(5) *Useless.*




(6) *Bad.*

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Second.—It may be that though no error has been made, and the chart is quite accurate, the third angle laid off from the plotted position will not pass through the fourth object, or the bearing will not agree.

This will arise from improper selection of the first three objects, a subject of great importance, and one in which persons unused to this means of fixing are especially liable to make mistakes.

An examination of Figs. (5) to (13) will show the effect of different positions of the objects as regards the observer.

In these Figures, specimens of positions of objects from which bad, *i.e.*, unreliable, fixes were obtained, are given in (5) to (7). Good fixes are shown in (8) to (12). In all of them, A, B, C, are the objects, and D the resulting position of the ship. To avoid complication, the third circle, that passing through the two outer objects and the ship, is only given when it is necessary to demonstrate that the fix is good, as in (10) and (13).

In Fig. (5), the observer D is situated on the circle that passes through all three objects. In this case D may be anywhere between A and C as at D, $D^1$, and it is impossible to fix with these objects.

Though this is the only case in which theoretically this impossibility exists, and it seldom happens in practice that the three objects and observer's position lie precisely on the same circle, it is by no means unusual that the third object is found to be very close to the circle passing through the two others and the observer. In this case the effect for the purposes required is nearly the same, for it would be found (Figs. 6 and 7) possible to move the centre of the instrument a considerable distance either towards A or C without appreciably displacing either A, B, or C from the edges of their respective legs, and therefore the position D, cannot be exactly localised.

*The position of the observer, therefore, with respect to the circumference of the circle which passes through the three objects is the most important point to consider.*

### Bad Fixes.

If he is near to this circle, *on the far side from the centre object*, the fix will be in all cases bad.

As this position is not always apparent to the inexperienced, it is advisable to give a hint as to the means of detecting it, and also to lay down a few practical rules for selecting objects that will be certain to give a good fix; leaving it to the navigator to find out, as he gains experience, the other positions which will also afford the necessary precision.

To ascertain if a fix is good, try to move the centre of the instrument from the position assumed, without at once displacing one of the objects; if this is possible, the fix is bad.

Avoid choosing objects of which the centre one is also the most distant. Though there are certain cases in which, under these circumstances, a good fix is obtainable, experience is necessary before attempting to make use of such objects.

## Good Fixes.

A fix is good when the circumferences of two of the three circles make a good cut of not less than 60° with one another. This can be reduced to the following practical rules.

When the observer is inside the triangle formed by the three objects, the fix will always be good, Fig. (8), but sometimes the angles may be awkwardly large for observation.

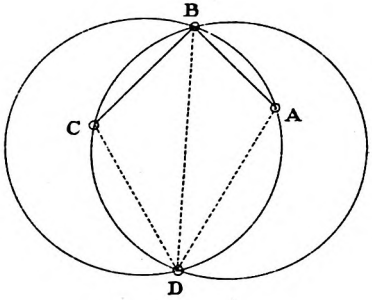
When he is outside the triangle, it will be a good fix—

1. If the centre object is nearer than either both or one of the others, and each angle is not less than 40° (Figs. 9 to 13).
2. When the three objects are equidistant from the observer, and neither angle is less than 70° (Fig. 12).
3. When one angle is large, and the other small, provided always that in the small angle the outer object is much more distant than the centre one (Figs. 4 and 10).

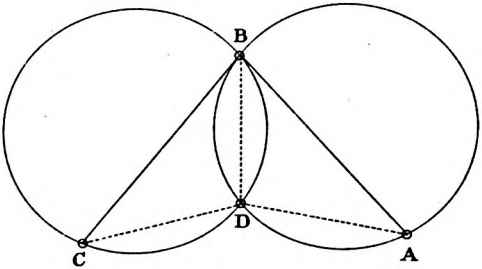
Figs. (10) and (13) are worthy of attention. Both of them are excellent, but judging only by the circles drawn through A B, B C, the intersections are unsatisfactory. It will be seen, however, that the third circle drawn through A C makes in each case a nearly rectangular cut.

A good and practical rule when under weigh is that, either, one of the angles should be altering very rapidly on change of place, or that both should be altering moderately rapidly.

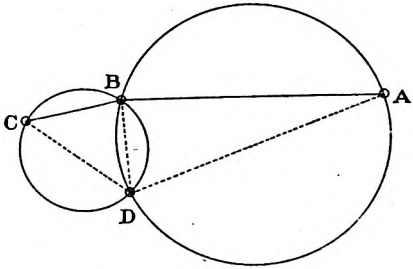
(7) *Bad.*




(8) *Good.*




(9) *Good.*

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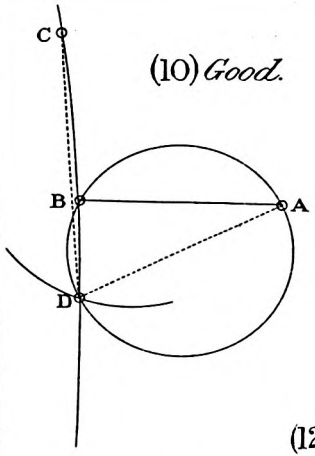
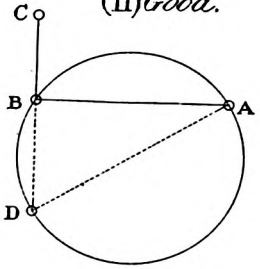
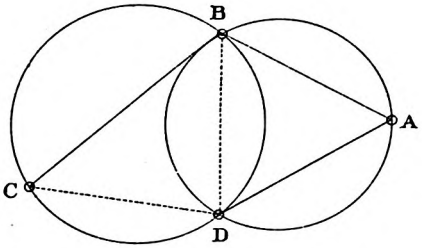
(10) *Good.*



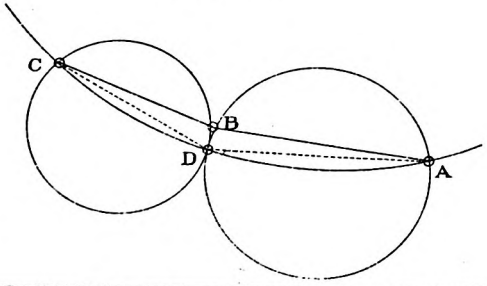

(11) *Good.*




(12) *Good.*




(13) *Good.*

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This should always be borne in mind, as when using the same "points," as is desirable, for several consecutive fixes, it may often be that, though originally well chosen, the change of the ship's position may have brought her to the circumference of the circle.

The moment that the centre object becomes the furthest of the three, the fix is to be avoided.

Unless the precautions above mentioned are observed in the selection of the object, the position given by the station pointer may be misleading, and hence *it is absolutely necessary, until the observer has learnt by experience to select such objects as are properly placed,* that one of the checks mentioned in the two last paragraphs on page 6 should be taken.

It must be noted, that when two objects shown upon the chart are precisely in line, Fig. (11), an excellent position is obtainable from one angle only to some third object, such angle not being less than 40°. This arrangement of the objects in "transit" is eagerly seized by all skilled navigators. It must, however, be borne in mind that if the two objects in "transit" are close together, compared with the distance of the ship from the nearest, the line joining them is not easy to draw correctly to such a distance, and consequently, error may in practice creep in. If the distance between the two objects is not less than two-thirds of the distance from the nearest object to the observer, the fix may be considered good.

## General Hints

In handling a station pointer it should never be lifted by the legs, but always held by the body or circle.

If the angle observed on the right is too small to be placed upon the station pointer, set the left leg to this small angle, and treating the left leg as the central one, bring the right leg round the circle until the index stands at the sum of the two angles observed.

To test the instrument, which should be done from time to time, compare the angles measured by the two legs with radiating lines drawn from a centre at certain angles. A paper for this

purpose is placed in the chart boxes of His Majesty's ships supplied with station pointers.

In taking the angles, if one person only is employed, it will be found convenient to observe, first, the angle which is altering the most rapidly.

In conclusion, whenever accuracy is desired, as when giving the position of a newly discovered rock, or a ship's exact position, *angles should always be used in preference to bearings*, and the more of them that are observed the better, as not only do they serve to check one another, but they also test the accuracy of the chart by which the ship is being navigated.

Many cases occur in Hydrographic Notes in which only two angles are given, observed to such ill-chosen objects as to cause the fix to be perfectly useless.